Nov
2020

समाचार पत्रों से चयित अंश
Newspapers Clippings

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खंड : 45 अंक : 254 01-02 नवंबर 2020

Vol.: 45 Issue : 254 01-02 November 2020

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The EurAsian Times

Sun, 01 Nov 2020

Directed Energy Weapons (DEWs) race: How is India competing against the US, Russia & China?

By Rajesh Kumar Sinha

When Hollywood's' Star Wars made its first appearance in the late 1970s on the global cinema landscape, it took the world by storm. Broadly labelled as a huge commercial success built around a wonderful science fiction story, almost forty years later it does not look a fiction any longer.

It has become real, a tangible and future means of warfare that is being rapidly explored and worked upon by few countries to ensure that their core national interests are not only maintained but also enhanced.

The Defence Research and Development Organisation (DRDO)'s ambitious Directed Energy Weapon (DEWs) ADITYA project is taking a big leap forward by making India a great military power through harnessing the power of laser and microwave.

DEWs use high-energy lasers and microwaves and this technology is considered a critical emerging military know-how on which all major powers are currently working.

The US, Russia, France, UK, Israel, China and of course India too, is working on DEWs. Though none of the militaries have deployed their DEWs in an operational capability yet, military analysts are of the view that the massive work being done in the domain, is certain to bring about a transformational change in military warfare in not-so-distant future.

In India, media reports have suggested that a national plan is afoot with short, medium and long-term plans to develop a number of DEWs variants up to 100 KWs of power. In August 2017, DRDO reportedly successfully tested a 1-KW laser weapon at Chitradurga on a target 250-metres away.

The target took 36 seconds to be hit. Parliamentary records have revealed that a couple of vehicle-mounted high power laser-directed energy systems have been worked upon by the DRDO and shown to the military for their feedback.

Further, the country is reported to have already developed KALI (kilo ampere linear injector), a linear electron accelerator for targeting long-range incoming missiles and more work on the advanced versions of KALI is underway.

A Chemical Oxygen Iodine Laser (COIL) as a 30-100KW vehicle-mounted gas dynamic high-power laser-based DEW by LASTEC is under development too. However, not much detailed information on DEW work in India is available. Except that both the Army and IAF have come up with roadmaps regarding their requirements for DEWs in the coming years.

Some of the works underway in DEWs domain in India are air defence dazzlers that will take on incoming enemy fighter jets or attack helicopters, may take a couple of years while 25KW laser systems to destroy missiles at the terminal stage at 5-7 km, might take another five years to become operational.

In order to make current nascent capability operational in a short period of time, two of the DRDO laboratories, Centre for High Energy Systems (CHESS) and Laser Science & Technology Centre (LASTEC) are in the process of eventually involving the burgeoning private sector in the R&D works.

DEWs are very critical for the Indian security environment, especially in the context of the current tense relationship with China and Pakistan. One also needs to note that China is working furiously on various forms of DEWs, including laser weapons.

Laser Weapons

Laser-based or microwave-based high-power DEWs (Direct Energy Weapons) can easily incapacitate almost all ariel targets like drones, missiles and other targets without leaving any physical debris.

It has also tested a tactical laser system bearing striking resemblance to US Navy's Laser Weapon Systems (LaWS), an anti-surface, anti-air defensive weapon system. It is reported to be working on developing airborne laser pods that might be mounted on PLA warplanes like J-15, J-20s and could be used to shoot down air-to-air missiles or blind enemy pilots within visual range or even destroy larger fighter jets or ballistic missiles.

Russia too has made a lot of progress in this field. It has officially confirmed moving forward with deploying DEWs in its weaponry.

From an operational and strategic perspective, DEWs are weapons of the future. Security experts are of the view that once they are developed to a certain level, the ability to effectively target the incoming unmanned UAVs and drones which currently are doing extremely well in the Armenia-Azerbaijan war will increase manifold.

Further, the air dogfights will become obsolete and countries having these weapons will enjoy a great deal of strategic superiority over adversaries.

https://eurasiantimes.com/directed-energy-weapons-dews-race-how-is-india-competing-against-the-us-russia-china/

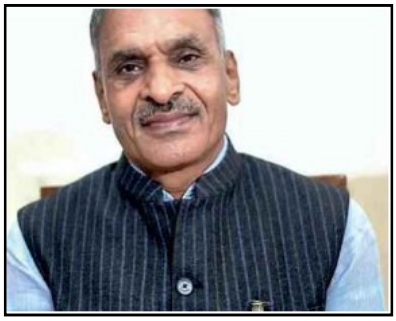
THE TIMES OF INDIA

Sun, 01 Nov 2020

'Somebody had to take the first step in def production, we did'

By Shishir Arya

A decade ago, with a corporate office in the middle-class Bharat Nagar locality, Solar Industries Limited (SIL) was — like its low-profile chairman Satyanarayan Nuwal — not much known. It supplied commercial explosives for mining projects, and to leading players globally.



Since 2010, the company has emerged as a key player in the defence segment. From making explosives for mines and quarries, it has now got technology from Defence Research and Development Organization (DRDO) for over a dozen items, ranging from grenades to propellants for Brahmos missile. In most of the cases, it's the sole technology partner from the private sector.

With its sudden rise, controversies too have arisen, with Solar Group dubbed as a 'favourite' of the BJP government, and in 2015 its detonators being found with Islamic State (IS) operatives. Solar Industries Chairman Satyanarayan Nuwal speaks to TOI. Excerpts from the interview...

Q. It is said that it was because of your links with the RSS and BJP that you could bag all the transfer of technologies (ToTs) from DRDO. This could be an out-of-the-way favour to your company?

A. I know politicians in their individual capacity, but that does not mean I have any political affiliation. If they say I was favoured by the BJP, then let me clarify that I got the licence in 2011, when the UPA government was in power.

Q. The issue of Solar Industry detonators being found with ISIS has cropped up again. The decision of granting contracts and ToTs was questioned on that basis.

A. It's an old matter and we have already clarified. SIL was not alone, material from 60 different companies was found with the militia. We have units making commercial explosives in Turkey, Malaysia, South Africa, Ghana and Nigeria. Theft of explosives from the users' end cannot be ruled out. There have been many such incidents in the entire sector. Even Conflict Armament Research (CAR), which had reported the matter, has given us a clean chit. (CAR in its letter issued in 2019 has said it does not say that SIL had carried out any illegal trade.)

Q. Do you think the system needs to be strengthened to prevent diversion.

A. We have already begun bar coding each of our cartridges meant for commercial use, both in India and abroad. This will ensure precise tracing. The practice in the industry is to just bar code the container. Despite the higher cost, each piece is being bar coded.

Q. How did you diversify into defence from being a manufacturer of commercial explosives.

A. It started in 2010-11 with a single contract to make pyros (propellant and ignition systems) for the ordnance factory. It was cleared by both ministry of defence and Ordnance Factory Board (OFB). The order was meant to fill the gap in existing supply, but it never took off. After a pause of around five years, there was a contract to make similar systems for Aakash missiles and then finally the latest multimode hand grenade. The grenades are the first ever order for a full-fledged ammunition system. The defence business is carried out under Economic Explosives Limited (EEL), a 100% subsidiary of SIL. We are the first private company to make an entire ammunition system.

Q. What is the order position for EEL at present?

A. The major order is of the multimodal hand grenades. It is under process at various stages for rest of the ammunition systems. After this, we expect to bag a contract to make Pinaka rockets. The company is making propulsion systems and similar components for Brahmos, Akash and even for satellites of ISRO.

Q. EEL is the sole ToT holder for a slew of ammunition types, from Pinaka rockets, anti-personal mines, anti-tank mines to aerial bombs. Questions are being raised how can a single company get all the TOTs.

A. Whenever DRDO or any of its labs want to share the technology, expression of interests (EOI) are invited. The private players respond to the EOIs and those having the required infrastructure at their units get the technology. Our company had applied only for the projects for which it has the manufacturing capacity. Some other companies too have got TOT for similar items but finally only EEL has developed the product. The company has technical collaboration with certain foreign players too.

Q. You have even got the TOT for the Brahmos missiles. How did it happen?

A. The propulsion system for the missiles were imported from Russia. The Russians said it was not easy to indigenize the component. However, we could make it in alliance with the DRDO and the first order was received. We expect to get fresh orders too soon.

Q. What is the investment in the defence projects and the turnover of EEL.

A. We have pumped in Rs600 crore in the defence business. However, the revenue is not more than 5% of Solar Group's overall turnover of Rs2,400 crore.

Q. There is always a concern orders from the armed forces cannot be viable for a private player.

A.That's true to a certain extent, which is the reason EEL has been sustaining losses so far. However, somebody had to take the first step, so we did. There is a huge gap in the current supply and the dependence on imports has to be reduced too. We hope to make gains once the order for Pinaka rockets is received. The Rs1,000 crore order can lead to profits. A major jump is expected as orders for other items under ToT materialize. It will also provide support to an entire system of ancillary industries. The export market will also be tapped eventually.

Q. How are you funding your defence venture, any plans to invest further or come up with an IPO.

A. So far the investment is being made out of internal accruals. We plan to invest another Rs1,300 crore but no IPO is planned. The fresh investments will also happen over a period of time from internal accruals only.

Q. What are your views on corporatisation of the OFB?

Corporatisation will certainly lead to competition over both quality and cost. As far as OFB is concerned, our company is too small a entity to pose any threat to such a mammoth organization. We will only be just another source of supply for the defence forces.

https://timesofindia.indiatimes.com/city/nagpur/somebody-had-to-take-the-first-step-in-def-production-we-did/articleshow/78973707.cms

Defence News

Defence Strategic: National/International

THE HINDU

Mon, 02 Nov 2020

Three new Rafale jets to fly non-stop from France to India

French Air Force refuelling plane to accompany them

By Dinakar Peri

New Delhi: Three Rafale fighter jets of the Indian Air Force are scheduled to arrive on November 4 flying non-stop from France, an official source said. With this, the IAF will have eight of the 36 Rafale jets in service.

"Three Rafale jets will fly directly from Istres in France to Jamnagar, an eight-hour-plus non-stop flight," the source said. They will be accompanied by French Air Force mid-air refuelling aircraft. "There will be three tankings in all," the source said.

Big boost: A Rafale aircraft after its induction into Golden Arrows Squadron of the IAF in September.

The first batch of five Rafale jets were formally inducted into the No.17 'Golden Arrows' squadron of the IAF on September 10 at the Ambala Air Force station. They arrived in India in July with a stopover at the Al Dhafra airbase in the United Arab Emirates (UAE). During the first leg of the flight from the Merignac airbase at Bordeaux in France to the UAE, the jets were accompanied by the French Air Force mid-air refuellers. For the journey from the UAE, they were accompanied by IAF midair refuellers.

The five jets, three single seat and two twin-seater trainers, were flown from France by IAF pilots led by Commanding Officer of No. 17 squadron Group Captain Harkirat Singh. The Indian Embassy in France had said in a statement that delivery of all 36 aircraft would be completed as per schedule by 2021-end. The second squadron would be based at Hasimara in West Bengal.

Last month, IAF chief Air Chief Marshal R.K.S. Bhadauria said the IAF would get three or four Rafales every two or three months till all 36 jets were delivered and that the first squadron would be fully ready by 2021-end and the second by 2023. "In the next three years, we will see the Rafale and Light Combat Aircraft (LCA) MK1 squadrons operating with full strength, along with additional Su-30MKI and MiG 29 aircraft, that are being ordered in addition to the current fleets," he said.

India has contracted 36 Rafale omni-role fighter jets from France in fly-away condition with 13 India Specific Enhancements (ISE) under a €7.87-billion Inter-Governmental Agreement signed in September 2016.

https://www.thehindu.com/news/national/three-new-rafale-jets-to-fly-non-stop-from-france-to-india/article32998651.ece

THE TIMES OF INDIA

Sun, 01 Nov 2020

India to rebalance forces, firepower to LAC and IOR

By Rajat Pandit

New Delhi: India now plans to fast-track its ongoing rebalance of military forces and firepower to the northern borders with China and the critical Indian Ocean Region (IOR), in a decisive shift away from the decades-long focus on the western front with Pakistan and combating militancy.

The just-concluded Army commanders' conference discussed the "reorientation of forces" along the northern and western borders, with the operational challenges along the 3,488-km Line of Actual Control (LAC) with China being analyzed in the military operations directorate.

Similar "operational recalibration" for "tackling the clear and present threat" from China is underway in the IAF and Navy amid the continuing deadlock in the military confrontation in eastern Ladakh, which has entered it seventh month now.

"The rebalance from the land borders with Pakistan to the LAC and the maritime domain was gradually underway for some years now. But Ladakh has accelerated all the plans," said a top officer on Saturday.

"The operational readiness along the Line of Control (LoC) with Pakistan, of course, cannot be diluted since the two-front situation is a reality. But China has become the primary front, with Pakistan being relegated to the secondary one," he added.

On the China front, the proposed measures range from the "permanent deployment" of additional infantry brigades and armoured regiments in eastern Ladakh as well other stretches of the LAC to cranking up force-levels and infrastructure on the island territories on the western and eastern seaboards.

In eastern Ladakh, India has pumped in three additional divisions (each has around 12,000 soldiers) since May to supplement the 3 Infantry Division already based there, along with T-90S and T-72 tanks, howitzers and surface-to-air missile batteries.

"The People's Liberation Army has also dug-in for the long haul. If there is de-escalation, some forces will be de-inducted from Ladakh. But yes, the LAC is now set to witness permanent troop deployments like the LoC with Pakistan," said another officer.

Budgetary constraints, however, will be a limiting factor. Officials, however, say several schemes have been set in motion to optimize combat capabilities despite the fund crunch.

The IAF, for instance, is finalizing a plan to "dry lease" or acquire six "pre-owned" mid-air refueling aircraft to extend the reach of its fighter jets. Though IAF overall needs 18 such "force-multipliers", it is currently making do with just six IL-78 aircraft inducted in 2003-2004.

"The new Defence Acquisition Procedure, in force from October 1, enables leasing of military equipment and platforms for urgent operational requirements. This will cut time delays and initial capital costs," said an official.

The Navy has already gone in for a major rationalization and re-prioritization of its long-term force level plans and arms procurement projects, which included the recent scrapping of the over Rs 20,000 crore tender for four large amphibious warfare warships or landing platform docks (LPDs), as was earlier reported by TOI.

"The overall aim is to get the maximum bang for the buck, cutting down on the frills and wasteful expenditure," said the official. But there is also the acknowledgement that more funds will be required than what have been allocated.

The recent move towards "force accretion" and "military infrastructure development" in the strategically-located Andaman and Nicobar archipelago, as a counter to Chinese moves in the IOR, for instance, will require sustained funding over the next several years.
https://timesofindia.indiatimes.com/india/india-to-rebalance-forces-firepower-to-lac-and-ior/articleshow/78976867.cms

Hindustan Times

Sun, 01 Nov 2020

Ladakh temperature drops to sub-zero, focus shifts to countering Chinese Navy

Indian military planners have decided to give top priority to Eastern Naval Command and island territories of Andaman and Nicobar Islands, and Lakshadweep to counter any threat from Chinese PLA Navy

By Shishir Gupta

With the onset of first snow and sub-zero temperatures in East Ladakh, the Indian Army troopers, equipped with US-made blizzard masks, have settled down for the winter against the People's Liberation Army (PLA), with the focus of national security planners now shifting to beefing maritime security.

While the four-nation QUAD multilateral exercises under Malabar begin next Tuesday, the Indian military planners have decided to give top priority to Eastern Naval Command and island territories of Andaman and Nicobar Islands, and Lakshadweep to counter any threat from PLA Navy in Indian Ocean. The Western Naval Command has also been asked to spread out its assets with Karwar base in Karnataka as focus.

India has one dedicated amphibious brigade spread between Thiruvananthapuram and the Andaman and Nicobar Islands Command in Port Blair(Indian Navy)

The plan follows a security assessment that pitched concern around China's PLA Navy way over the maritime threat from the Pakistan Navy.

In this context, the national security planners are considering raising another amphibious brigade, one for eastern and western seaboard, for offensive operations in the future. As of now, India has one dedicated amphibious brigade, whose elements are spread between Thiruvananthapuram and Andaman and Nicobar Islands Command in Port Blair. The amphibious forces are specialised in launching a counter-offensive from sea using landing ship tank (LST) vessels such as INS Jalashwa and projecting power in the region and beyond. The planners are considering having one full brigade in Thiruvananthapuram, and the second stationed either at Visakhapatnam or AN Islands.

India's island territories are at the heart of Indian Navy's operational plan in the Indian Ocean as they dominate the major shipping lanes from Suez Canal and Persian Gulf to South-East and North Asia via Malacca Strait. The Indian Air Force fighter jets, armed with Brahmos missiles, can strike at any moving target in and around Malacca, Sunda or Lombard straits in the worst-case scenario. These three straits are the only way to access the South China Sea from Indian Ocean. Shipping costs mount manifolds if the ships have to be diverted from the Malacca Strait to other two straits.

Despite the strategic leverage that the island territories represent, the Indian Navy is still largely focused on Mumbai and Visakhapatnam with the AN Command left to the tri-services headquarters. With the military theatre commands in the offing, both AN Islands and Lakshadweep

are going to be the hub of India's maritime strike capabilities. Lakshadweep lies on the Nine Degree Channel, the most direct route for East Asia-bound ships from the Persian Gulf.

Given that India and the US have tied up for Indian Ocean Region with institutionalised tie-ups with American Indo-Pacific, Central Command and African Commands, the QUAD countries will project maritime surveillance and dominance in their region with assets communicating and sharing information through secure military communication channels among air, surface and underwater combatants made possible by the Communications Compatibility and Security Agreement signed in 2018.

https://www.hindustantimes.com/india-news/eye-on-china-india-will-raise-2nd-amphibious-brigade-to-counter-pla-navy/story-BXOnFMItufSAw0MOPuf8BN.html

TSG SundayGuardianLive

Sun, 01 Nov 2020

Intelligence: Indian agencies get a BECA boost

Resources generated by US' National Geospatial-Intelligence Agency will now be available to India

By Abhinandan Mishra

New Delhi: When 79 US commandos and Cairo the dog, a Belgian Malinois, stormed into the Abbottabad, Pakistan, residence of Al Qaeda chief Osama Bin Laden at 1.30 am (IST) on 2 May 2011 in order to neutralise him, they knew the exact number of steps that they will have to take from the landing zone where their modified Black Hawk helicopters would land to reach the third floor room of Laden, where he was sleeping.

This was possible because for months they had studied and analysed the exact replica, down to the number of stairs and the number of doors of Laden's hideout. The model of the house took six weeks to be built and 1 inch on the model meant 7 feet on ground.

So, when the commandos landed at the doorstep of Laden, it was like the proverbial walk in the park for them. They knew where the doors were, where the kitchen was and which side they had to turn as they "cleared" the three-floor house.

For a long time, it was assumed that someone from the inside, who knew the house inside out, had helped the commandos. However, this swift execution of such a difficult mission in an inhospitable environment, which was over within nine minutes of the commandos entering the Laden compound, was made possible because of the pin-pointed intelligence that included very high resolution images gathered and the model of the house built by men and women at the National Geospatial-Intelligence Agency, or the NGA, which is located at Fort Belvoir North Area in Springfield, Virginia.

The importance and the resources at the disposal of the NGA can be gauged from the fact that it is the third-largest government building in Washington after the Pentagon and the Ronald Reagan Building. (The helicopters landed in Laden's house at Abbottabad at 1 am IST, Laden was shot at 1.09 am and by 1.40 am, every commando was out of Abbottabad.)

As per intelligence experts, the NGA, among the many US agencies that were tracking Laden, perhaps played the most crucial role in closing the Laden chapter.

When Indian Defence Minister Rajnath Singh and External Affairs Minister S. Jaishankar signed the Basic Exchange and Cooperation Agreement (BECA) with their US counterparts—United States Secretary of Defense Mark Esper and Secretary of State Michael Pompeo—earlier

last week, they paved the way for the use of similar high value intelligence data for Indian agencies, including those engaged in intelligence gathering and counter-terrorism.

The resources generated by NGA, that will now be available to India following the signing of BECA, have far-reaching advantages not just for intelligence agencies, but also the agencies and organisations involved in taking offensive and defensive actions on the border, including on India's eastern border.

The geospatial information, which BECA will generate for Indian agencies, will be useful both against China's People's Liberation Army (PLA) and against the state-supported terror groups functioning from inside Pakistan. It will also lead to training of Indian officials at the US National Geospatial Intelligence College.

"The Laden operation was carried out in 2011, almost 10 years ago. One can just speculate the improvement in intelligence generation by NGA that has happened since then. The capabilities of many of our offensive platforms, including ballistic missiles and drones, will grow exponentially due to the resources which we will be able to access post BECA. It will also allow us to take more prudent military decisions and allocate our resources more judicially," a senior government official said.

India has a number of space satellites that are focused on intelligence gathering, including EMISAT and RISAT-2, but the assets that it will be able to use post BECA are state-of-the-art and they will augment Indian offensive capabilities, both during direct and indirect war, manifold.

The provision "10 U.S. Code § 454" that talks about "exchange of mapping, charting, and geodetic data with foreign countries, international organizations, nongovernmental organisations, and academic institutions", will govern the BECA with India.

https://www.sundayguardianlive.com/news/intelligence-indian-agencies-get-beca-boost

The Indian EXPRESS

Mon, 02 Nov 2020

Explained: What is Army Aviation Corps, the youngest Corps of the Indian Army

A look at the Army Aviation Corps' history and its relevance in modern day battlefields, including in Counter Insurgency and Counter Terrorism (CI-CT) operations

By Sushant Kulkarni

Pune: The Army Aviation Corps (AAC), the youngest Corps of the Indian Army, celebrated its 35th Corps Day on November 1. We take a look at the arm that adds an air dimension to the Army's capabilities, its history, and its relevance in modern day battlefields, including Counter Insurgency and Counter Terrorism (CI-CT) operations.

The roots of Army Aviation Corps

The origin of the AAC can be traced back to the raising of the Army Aviation wing of the Royal Air Force in India in 1942, and the subsequent formation of the first Indian Air Observation Post in August 1947.

The Air Observation Post units primarily acted as artillery spotters – which are the elements that help the artillery in directing the fire and also giving air support to ground forces. In the wars of 1965 and 1971, the Air Observation Post helicopters played a key role in the battlefields by

On its 35th Corps Day, Director General & Colonel Commandant of the Army Aviation Corps laid a wreath at the National War Memorial, New Delhi. (Photo: Twitter/ @adgpi)

flying close to the enemy lines and helping ground assets spot targets.

The Corps was raised as a separate formation on November 1 in 1986. The AAC now draws its officers and men from all arms of the Army, including a significant number from the artillery.

Immediately after raising, the units of the Corps were pressed into action in Operation Pawan by the Indian Peacekeeping Forces, in the mostly jungle areas of Sri Lanka against the Tamil Tigers. Ever since, AAC helicopters have been an inseparable part of fighting formations in all major conflict scenarios, and a life-saving asset in peace times.

Over the years, the Corps has grown by additions of new units, equipment and ground assets, and along with this, its roles and capabilities too have grown.

In October last year, President Ram Nath Kovind presented the President's Colours to the Army Aviation Corps in a ceremonial parade held at Army Aviation Base at Nashik Road. The colours were received by the Combat Army Aviation Training School on behalf of the Army Aviation Corps. The President's Colours, which is a ceremonial flag, is awarded to military units or institutions as symbol of their excellence, and as recognition of their contributions both during war and peace.

The versatile role of AAC helicopters

The main roles played by the AAC choppers are that of reconnaissance, observation, casualty evacuation, essential load drops, combat search and rescue, thus adding an invaluable air dimension to the Army's capabilities. The AAC helicopters also participate in Humanitarian Aid and Disaster Relief (HADR) operations in peace times.

In some scenarios, Army helicopters can also act as Airborne Command Posts, replacing the ground command posts if needed. In all types of weather and terrains, AAC choppers have proved valuable not only in their battle roles, but also by saving numerous lives through medical evacuation flights.

The Indian Army has further sharpened the AAC edge by adding dedicated aviation units along with the various operational Corps and Command formations. The AAC currently operates Chetak, Cheetah, Lancer, Advanced Light Helicopter (ALH) Dhruv, and ALH Weapon System Integrated (WSI), also known as Rudra. Acquisition of new helicopters is in the pipeline, especially in the backdrop of concerns over the fleet of the versatile but ageing Cheetah and Chetak helicopters.

While initially, AAC operated non-weaponised helicopters and attack helicopters were only with the Air Force, post 2012, the government has allowed induction of weaponised choppers in the AAC.

Role in modern day battlefield, in counter insurgency-terrorism ops

In the modern-day battle formation, elements like infantry, short and long artillery, armoured formations and Army helicopters are closely linked with each other. These use information and data points collected from ground and airborne surveillance assets and satellites. Helicopters are a key element of this battlefield, which is going to become even more technology-intensive in the future.

These battle machines, which can perform both observation/recce and attack functions, are an ideal choice for CI-CT operations to tackle difficult terrains, and also avoid ground-based threats like Improvised Explosive Devices and ambushes. Having said this, use of air assets in CI-CT operations is always done with caution because of the possibility of collateral damage.

With the motto Suveg and Sudridh (Swift and Sure), the youngest corps of the Indian Army is set to further grow in its tactical importance in the battlefield. Serving officers and veterans from the Corps say that the corps will need a stronger push of modernisation and enhancement of assault capabilities to take further its role of 'force multiplier.'

On Sunday (November 1), the Indian Army tweeted, "Suveg and Sudhidh. General MM Naravane and all ranks of Indian Army convey best wishes to all ranks of Army Aviation Corps on the occasion of 35th Army Aviation Corps Day."

https://indianexpress.com/article/explained/explained-what-is-army-aviation-corps-the-youngest-corps-of-the-indian-army-6912908/

Sun, 01 Nov 2020

Dynamatic inks pact with CSIR-CSIO for joint development of futuristic solutions

Dynamatic Technologies Limited and Central Scientific Instruments Organisation (CSIR-CSIO) have signed a MoU for jointly designing, developing and manufacturing futuristic solutions for the Defence and Aerospace, Healthcare and Agriculture industry.

"Our partnership with CSIO is aligned to Government of India's vision of #AtmaNirbharBharat. Symbiotic relationships between private sector and government research labs will go a long way in our endeavour to build a self-reliant India. Dynamatic under the leadership of Dr. Udayant Malhoutra, CEO & MD, Dynamatic Technologies Limited, has been championing Indigenisation of defence production in partnership with PSU's and DRDO since early 90's. This partnership between CSIO and Dynamatic is aimed at making futuristic solutions for Defence and Security, Healthcare and Agri industry." Arvind Mishra, ED & Global COO, Dynamatic Hydraulics

About Dynamatic

Dynamatic Technologies manufactures highly engineered products and solutions for the Aerospace and Defence, Hydraulics and Automotive businesses. The company has manufacturing facilities in India, UK, Germany and USA and is in the global supply chain of leading OEMs in these sectors. Dynamatic has three design laboratories in India and Europe and is a leading Private R&D Organisation, with numerous inventions and patents to its credit. Additionally, the company owns and operates a sophisticated metrology laboratory, a material sciences laboratory and a research farm. The Company and its Subsidiaries employ around 65 scientists and 650 engineers with expertise in Mechanical Engineering, Advanced Computer Aided Engineering, Materials & Metallurgical Engineering, Fluid Dynamics and Defence & Aerospace Research.

CSIR Quote

CSIR imparts and undertakes cutting-edge research in various areas of science, engineering, design, management, and humanities and Dynamatic is engaged in the business of designing and building highly engineered products for Aeronautic, Hydraulic, Automotive and Security applications and to tap the synergy of these two organisations a Memorandum of Understanding for collaboration was signed between Dynmatic Technologies Limited and Council of Scientific and Industrial Research to develop collaborative activities in the research areas of mutual interest, on a basis of equality and reciprocity in the areas of Multi-spectral surveillance payloads of Unmanned Aerial Systems (UAS), Spraying technologies including electrostatic techniques for agricultural purposes using UAS, Instrumentation for ventilators and respirators and Instrumentation for homeland security applications. Prof. Ramakrishna believes that the partnering with Dynamatic was an extremely strategic one for CSIO and he hoped that it will lead to large scale translation of CSIO's research into products.

About CSIR-CSIO

CSIR is India's premier research institution to conduct original research of the highest standard and to provide leadership in technological innovation for the industrial growth of the country.

CSIR imparts and undertakes cutting-edge research in various areas of science, engineering, design, management, and humanities.

CSIO is under the Physical Sciences Cluster of CSIR. CSIO has infrastructural facilities in the areas of microelectronics, optics, applied physics, electronics, and mechanical engineering. R&D programmes are in food & agriculture, health and rehabilitation, avionics, snow and seismic monitoring in strategic sector, landslide and structure health monitoring for public safety, and bio and nano sciences.

https://www.defenceaviationpost.com/2020/10/dynamatic-inks-pact-with-csir-csio-for-joint-development-of-futuristic-solutions/

DNA
DAILY NEWS & ANALYSIS

Sun, 01 Nov 2020

Russia fulfills India's defence requirement list handed over in June

The defence requirement was handed over during Defence Minister Rajnath Singh's June visit to Moscow

By Sidhant Sibal, Edited By Arjit Saha

Russia has fulfilled requirements related to India's defence equipment list handed over in the month of June. Sources confirming the development said that the requirement included light guns, projectiles, bombs.

A number of contracts were signed during the summer to implement India's requirement.

The defence requirement was handed over during Defence Minister Rajnath Singh's June visit to Moscow. The Defence Minister had gone to Russia to participate in Victory day parade-celebration of Soviet victory and surrender of Nazi Germany.

The visit of India's defence minister came in the backdrop of Galwan incident at the line of actual control in Eastern Ladakh on June 15. In the incident, India lost 20 soldiers, while China also suffered casualties, but it never came out with any official number.

However, nothing is known yet on MiG 21 which is slated to be procured from Russia. In July, New Delhi had approved the proposal for procurement of 21 MiG-29 along with upgradation of existing 59 MiG-29 aircraft and procurement of 12 Su-30 MKI aircraft.

One of the key elements of India-Russia ties is defence.BrahMos Missile System as well as the licensed production SU-30 aircraft and T-90 tanks are examples of India-Russia flagship cooperation.

An agreement on the cooperation in the production of spare parts for Russian/Soviet military equipment was signed during the 20th Annual India Russia Bilateral Summit in Vladivostok in September 2019.

In March 2019, PM Modi announced the JV– Indo-Russian Rifles Pvt. Ltd. for production of AK Series Assault Rifles at Ordnance Factory Korwa under the 'Make-in-India' program.

https://www.dnaindia.com/india/report-russia-fulfills-india-s-defence-requirement-list-handed-over-in-june-2853521

The EurAsian Times

Mon, 02 Nov 2020

Greece rushes to establish military alliance with India as Turkey, Pakistan develop close defence collaboration

By Younis Dar

India and Greece recently had a security briefing about the current situation in the eastern Mediterranean region. The Foreign Ministers of the two countries held virtual talks on October 29 about a range of regional and multilateral issues.

The situation in the eastern Mediterranean has been tense with Turkey and Greece involved in a dispute over energy exploration rights and maritime boundaries in the area. The two neighbours have been wrangling over military games in the region despite both being part of the NATO alliance.

Complicating the matters have been Erdogan's plans to install the high-end Russian S-400 air defence system in the country, which has left even Washington worried. Greece's Minister of Defense Nikos Panagiotopoulos was quoted by a news agency as saying the decision was enough to prove that potentially Turkey, whether it wanted to or inadvertently, would prove to be a source of "undermining NATO's cohesion from within."

He added that if nothing was done, then Turkey's leaders have all the right to believe that "they can go on uninhibited, demonstrating that type of hostile and confrontational behaviour that threatens stability in the whole region." He said that deployment of the Russian system will be "too much of an aggressive move" on part of Turkey.

However, there was a pause in the exchange of heated words between the countries after a 7-intensity earthquake hit both the countries doing considerable damage. The leaders of the two countries expressed solidarity on social media, pledging to help each other while sidelining existing differences.

India, Greece Virtual Meeting. Via: Twitter

With Turkey's increased bonhomie with its iron brother Pakistan in recent times, Greece is exploring an alliance of its own. Although supported by many European nations in its maritime disputes with Turkey, Greece is reaching out to a new player in the new global power tussle – India.

India can serve as a valuable partner for Greece, with the emerging South Asian country's immense economic and military clout, and most importantly, its historic animosity with Pakistan – makes it a match made in heaven.

India's relations with Turkey too have been undermined after Ankara criticized Modi's Kashmir policy at the UN. The two nations were subsequently embroiled in a war of words over the issue.

Turkey is gaining increased support from Pakistan's political and military counterparts, which has worried Greece, who has, therefore, been forced to look in all directions to help bolster its military infrastructure.

India too, on the other hand, has been eager to enhance bilateral relations with Greece, and the two countries have even talked of establishing military relations, reportedly, in light of the recent events.

After the virtual talks between the two countries, Greek Foreign Minister Nikos Dendias tweeted, "In a video conference with India FM Dr S Jaishankar. Strengthening Greek, India relations & developments in Eastern Mediterranean & South Asia in focus."

Although there is a renewed focus on enhancing bilateral relations, the two countries share common approaches to many international issues, such as UN reforms and Cyprus.

Greece has consistently supported India's core foreign policy objectives. Greece participated with India in the 6th National Delhi Declaration on Nuclear Disarmament in 1985.

After his recent visit to the Indian embassy, the Greek Defense Minister Nikos Panagiotopoulos is reported to have tweeted, "Meeting with the Ambassador of India to Greece, Amrit Lugun, in the context of his ceremonial visit today to the Ministry of Foreign Affairs.

We discussed issues of further deepening our bilateral relations in the defence sector and promoting cooperation between the defence industries of our two countries."

The security analysts quickly drew upon the importance of the military relations between India and Greece, and how such cooperation would ultimately confront the Turkish-Pakistani defence axis in the future.

They argue that it will be difficult for Ankara to confront a militarily strong alliance, backed by major powers since Turkey is facing an acute economic and financial crisis at the moment.

Some Greek experts believe that India and Greece could also open up to the possibility of holding joint naval exercises since Turkey and Pakistan have already been holding such exercises in the past.

They suggest that Indo-Greek exercises could be kicked off in the strategically important Aegean Sea or even the eastern Mediterranean.

As the new geopolitical developments divide the world into two power blocs, the East Mediterranean conflict will create further divisions in the opposing fronts, forcing more nations to join the two opposing blocs, led by the US and China.

With the US and Russia coming to rival each other in the Greece-Turkey conflict over the S-400 sale, the Mediterranean conflict is surely going to reinforce the existing two-bloc world order, with India and China siding with opposing fronts.

https://eurasiantimes.com/greece-rushes-to-establish-military-alliance-with-india-as-turkey-pakistan-inch-close-to-defence-pact/

NAVALNEWS

Sun, 01 Nov 2020

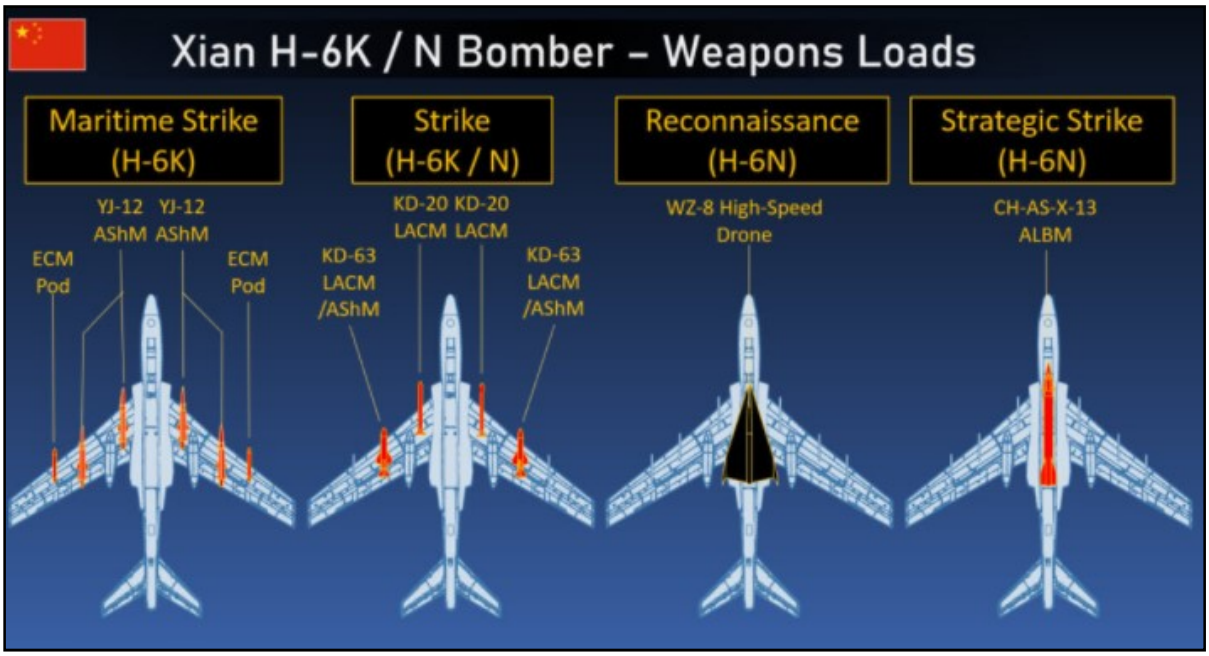
China's new aircraft carrier killer is world's largest air-launched missile

H I Sutton sheds some light on China's latest aircraft carrier killer: The CH-AS-X-13 air-launched anti-ship ballistic missile (ASBM)

By H I Sutton

Navies are racing to develop hypersonic missiles which may change the pace of naval warfare. Russia will deploy the Zircon hypersonic missile aboard warships and submarines. The US Navy has started down the path of the common hypersonic glide body (c-HGB) for its destroyers. Meanwhile China's latest hypersonic weapon is something completely different; it is air launched.

The massive new missile, labelled CH-AS-X-13, is probably the largest air-launched missile in the world.



The missile was first reported by Ankit Panda, the Stanton Senior Fellow at the Nuclear Policy Program, Carnegie Endowment for International Peace, in April 2018. More recently candid images have appeared on Chinese social media. These provide a clearer view of the novel weapon.

Analysts believe that it may be intended to target high-value warships, particularly aircraft carriers. This makes it an anti-ship ballistic missile (ASBM). And it appears to be carrying a hypersonic glide vehicle (HGV). This may give it extended range and increase survivability against air defenses.

The CH-AS-X-13 may be closely related to the ground based DF-21D anti-ship ballistic missile. Image analysis suggests that it has different dimensions however, so may use a different rocket motor. The most likely reason for this would be the physical restrictions imposed by carrying it under an H-6 bomber. Additionally it appears to be equipped with a hypersonic glide vehicle (HGV) similar to the one seen on the DF-17 ballistic missile. Clearer images in the future may clarify this.

The DF-21D is believed to have a range in excess of 1,500 km. The CH-AS-X-13 may have a similar range, or possibly further due to the aerial launch and a hypersonic glide vehicle. Either way, being carried by a bomber will massively increase its overall reach. The H-6N version which

carries it has aerial refueling to further increase their range. The CH-AS-X-13 is therefore a threat beyond the first island chain and South China Sea. It could potentially hit targets in the vast expanse of the Pacific Ocean, or Indian Ocean.

Even if the missile has this incredible range it will face challenges reaching its full potential. Finding and tracking an aircraft carrier at extreme ranges may be the Achilles' heel. And a lot may depend on the survivability of the bomber itself, and the number of aircraft available for the mission. Context, of course is everything.

Chinese Air Force Xian H-6N bomber launching a CH-AS-X-13 anti-ship ballistic missile over the South China Sea

The H-6 bomber is not limited to the CH-AS-X-15 however. It can also carry a range of anti-ship missiles. Foremost among these is the YJ-12 supersonic missile. This is similar to the Russian Kh-31 (AS-17 Krypton) missile, but significantly larger. At least four YJ-12s can be carried, meaning that a squadron of bombers could launch a saturation attack on a Carrier Battle Group. The subsonic KD-63 (also commonly referred to as the YJ-63) can also be carried.

Having anti-ship ballistic missiles may also be used to message China's potential adversaries. On August 26 China test fired a DF-21D ASBM into the South China Sea. This was just weeks after the US Navy aircraft carrier USS Ronald Reagan had been exercising in the area. The CH-AS-X-13 adds another dimension to the threat to carrier battle groups, so its development alone can be seen as sending a clear message of China's increasing military confidence.

https://www.navalnews.com/naval-news/2020/11/chinas-new-aircraft-carrier-killer-is-worlds-largest-air-launched-missile/

Press Information Bureau
Government of India

Ministry of Science & Technology

01 Nov 2020 3:17PM

VAIBHAV Summit: A Unique Confluence of Resident and Overseas Indian Scientists/Academicians concludes successfully

The Summit throws up possibilities of collaborations in new and emerging areas of Science & Technology

VAIBHAV proposes a comprehensive roadmap for leveraging expertise/knowledge of global Indian researchers to address emerging challenges for universal development

The Prime Minister Shri Narendra Modi inaugurated the Vaishwik Bharatiya Vaigyanik (VAIBHAV) Summit, a global virtual summit of overseas and resident Indian researchers and Academicians on Gandhi Jayanti, 02nd October 2020 which concluded yesterday . About 2600 overseas Indians registered for the summit online. About 3200 panelists and about 22,500 academicians and scientists from India and overseas participated in this month-long series of webinars. The deliberations started on 3rd of October and concluded on the occasion of Sardar Vallabhbhai Patel Jayanti, 31stOctober 2020. About 722 hours of discussions under various verticals were organised by champion institutes from 3rd to 25th Oct and the outcomes were reviewed by the Advisory council chaired by Dr VK Sarsaswat, Member NITI Aayog and Prof K Vijay Raghavan, Principal Scientific Advisor to the Government of India, from 28th Oct to 31st Oct, 2020. Secretaries from various S&T departments and other ministries are members of this council including CSIR, DST, DRDO,ICAR, DOS, DAE, DBT, Health, Pharma, MEA, MoES, MeitY, MoE and ICMR. The champion institutes received critical feedback from the participants.

VAIBHAV and Atmanirbhar Bharat: VAIBHAV has led the way in establishing research capability as an important avenue towards Aatmanirbhar Bharat. It has paved the way for aligning contemporary research in the country towards a shared purpose in each area. Resident and overseas Indians have given an integrated perspective of research and academic capabilities to seamlessly contribute to India's S&T capability for global good. VAIBHAV has created an interactive and facile mechanism in the Cyberspace, and has promoted collaboration and the development of leadership. It is a grand initiative in the area of science and research not just for academic institutes but also for public funded R&D organizations and Industry that utilizes the outcome of research.

VAIBHAV: A wide spectrum of deliberations: VAIBHAV deliberations were held under a structured framework of many areas and subjects. This summit had many firsts in the history of academic and scientific conferences. The key highlights are

- 18 Verticals (Areas)
- 80 Horizontals (Subjects)
- 230 Panel Discussion Sessions
- 23 Days of Panel Deliberations
- 3169 Panelists
- 22500 Attendees
- 722 Hours of Formal Deliberations

Among panelists, 45% were overseas Indians and 55% were resident Indian academicians and scientists. In addition, about 200 hours of preparatory and practice deliberations were held before the formal panel meets. Overall Indian diaspora from 71 countries participated in this summit. This

is one of its kind initiative in the country, where such a mammoth scale of scientific discussions was undertaken on wide range of topics. In terms of participation, coverage of areas, intensity of discussions, number of hours spent on discussions, number of countries and quality of participants, this summit has created a benchmark in itself.

The Summit intended to "create an ideal research ecosystem, merging tradition with modernity to create prosperity". The discussions were held on computational sciences, electronics & communication, quantum technologies, photonics, aerospace technologies, health and medical sciences, pharma and biotechnology, agro-economy and food security, material & processing technologies, advanced manufacturing, earth sciences, energy, environmental sciences, management and social sciences.

VAIBHAV: New Collaborations in Emerging Areas -Certain areas of collaboration have emerged which were not stressed in the past, such as bioremediation, urban ore recycling and metal organics. Experts debated on the future electricity grids, interactive but islandable microgrids and related technologies key to electrification in India and maintaining resilience. At one time-zone in the cyberspace, a session was discussing the importance of assembly packaging various functionality over a single chip, while at the anothertime-zone technical ideas with respect to trapped ions and atomic clock were being proposed.To name just a few, wafer level packaging, 3D integration for MEMS, Heterogeneous integration of 2D materials on Silicon platform, Full Mission Mode Engine Cycle Analysis, Aero Elastic Analysis of Fan, Hot Turbine Blade Cooling Technology, Membrane separation for purification of elements, Ge purification for detector application, Highly doped Ge for THz and Mid IR frequencies are some of the areas of collaborations are identified.

VAIBHAV –RESPOSE & WAY FORWARD: While a panelist described Vaibhav to be 'encouraging grounded scientists and academicians', an organizing institute measured it by saying. It was a 'historical and mammoth exercise without flashy names'. On the sidelines of the summit, resident researchers are discussing with their international collaborators to take forward indigenous technologies to maturation. A panel was of the view that "directed research support, regulatory requirement for industries to identify future technical trajectories, and incentives to promote academia-industry collaboration" are key mechanisms for enabling research collaboration and commercialization.

The summit has proposed a comprehensive roadmap leveraging the expertise and knowledge of global Indian researchers for addressing emerging challenges for universal development. The Summit documentation and recommendations will be submitted formally to the advisory council for further directions. The summit reflected upon new avenues of research, strengthening of areas of research ecosystem, collaboration possibilities and cooperation instruments with academia/scientists in India and abroad. The goal is to create a broader ecosystem of knowledge and innovation in the country through global interactions, for India and the world.

https://pib.gov.in/PressReleseDetailm.aspx?PRID=1669320

PHYS.ORG

Mon, 02 Nov 2020

Space station marking 20 years of people living in orbit

By Marcia Dunn

The International Space Station was a cramped, humid, puny three rooms when the first crew moved in. Twenty years and 241 visitors later, the complex has a lookout tower, three toilets, six sleeping compartments and 12 rooms, depending on how you count.

Monday marks two decades of a steady stream of people living there.

Astronauts from 19 countries have floated through the space station hatches, including many repeat visitors who arrived on shuttles for short-term construction work, and several tourists who paid their own way.

The first crew—American Bill Shepherd and Russians Sergei Krikalev and Yuri Gidzenko—blasted off from Kazakhstan on Oct. 31, 2000. Two days later, they swung open the space station doors, clasping their hands in unity.

In this Oct. 29, 2000, file photo, the Soyuz booster is transported to the launch pad at the Baikonur Cosmodrome in Kazakstan. Two days later, U.S. astronaut Bill Shepherd, and Russian cosmonauts Sergei Krikalyov and Yuri Gidzenko blasted off to become the first residents on the International Space Station. (AP Photo/Mikhail Metzel, File)

Shepherd, a former Navy SEAL who served as the station commander, likened it to living on a ship at sea. The three spent most of their time coaxing equipment to work; balky systems made the place too warm. Conditions were primitive, compared with now.

Installations and repairs took hours at the new space station, versus minutes on the ground, Krikalev recalled.

"Each day seemed to have its own set of challenges," Shepherd said during a recent NASA panel discussion with his crewmates.

The space station has since morphed into a complex that's almost as long as a football field, with eight miles (13 kilometers) of electrical wiring, an acre of solar panels and three high-tech labs.

"It's 500 tons of stuff zooming around in space, most of which never touched each other until it got up there and bolted up," Shepherd told The Associated Press. "And it's all run for 20 years with almost no big problems."

"It's a real testament to what can be done in these kinds of programs," he said.

Shepherd, 71, is long retired from NASA and lives in Virginia Beach, Virginia. Krikalev, 62, and Gidzenko, 58, have risen in the Russian space ranks. Both were involved in the mid-October launch of the 64th crew.

The first thing the three did once arriving at the darkened space station on Nov. 2, 2000, was turn on the lights, which Krikalev recalled as "very memorable." Then they heated water for hot drinks and activated the lone toilet.

"Now we can live," Gidzenko remembers Shepherd saying. "We have lights, we have hot water and we have toilet."

The crew called their new home Alpha, but the name didn't stick.

Although pioneering the way, the three had no close calls during their nearly five months up there, Shepherd said, and so far the station has held up relatively well.

NASA's top concern nowadays is the growing threat from space junk. This year, the orbiting lab has had to dodge debris three times.

As for station amenities, astronauts now have near-continuous communication with flight controllers and even an internet phone for personal use. The first crew had sporadic radio contact with the ground; communication blackouts could last hours.

While the three astronauts got along fine, tension sometimes bubbled up between them and the two Mission Controls, in Houston and outside Moscow. Shepherd got so frustrated with the "conflicting marching orders" that he insisted they come up with a single plan.

"I've got to say, that was my happiest day in space," he said during the panel discussion.

With its first piece launched in 1998, the International Space Station already has logged 22 years in orbit. NASA and its partners contend it easily has several years of usefulness left 260 miles (400 kilometers) up.

The Mir station—home to Krikalev and Gidzenko in the late 1980s and 1990s—operated for 15 years before being guided to a fiery reentry over the Pacific in 2001. Russia's earlier stations and America's 1970s Skylab had much shorter life spans, as did China's much more recent orbital outposts.

Astronauts spend most of their six-month stints these days keeping the space station running and performing science experiments. A few have even spent close to a year up there on a single flight, serving as medical guinea pigs. Shepherd and his crew, by contrast, barely had time for a handful of experiments.

The first couple weeks were so hectic—"just working and working and working," according to Gidzenko—that they didn't shave for days. It took awhile just to find the razors.

Even back then, the crew's favorite pastime was gazing down at Earth. It takes a mere 90 minutes for the station to circle the world, allowing astronauts to soak in a staggering 16 sunrises and 16 sunsets each day.

The current residents—one American and two Russians, just like the original crew—plan to celebrate Monday's milestone by sharing a special dinner, enjoying the views of Earth and remembering all the crews who came before them, especially the first.

But it won't be a day off: "Probably we'll be celebrating this day by hard work," Sergei Kud-Sverchkov said Friday from orbit.

One of the best outcomes of 20 years of continuous space habitation, according to Shepherd, is astronaut diversity.

While men still lead the pack, more crews include women. Two U.S. women have served as space station skipper. Commanders typically are American or Russian, but have also come from Belgium, Germany, Italy, Canada and Japan. While African-Americans have made short visits to the space station, the first Black resident is due to arrive in mid-November on SpaceX's second astronaut flight.

Massive undertakings like human Mars trips can benefit from the past two decades of international experience and cooperation, Shepherd said.

"If you look at the space station program today, it's a blueprint on how to do it. All those questions about how this should be organized and what it's going to look like, the big questions are already behind us," he told the AP.

Russia, for instance, kept station crews coming and going after NASA's Columbia disaster in 2003 and after the shuttles retired in 2011.

When Shepherd and his crewmates returned to Earth aboard shuttle Discovery after nearly five months, his main objective had been accomplished.

"Our crew showed that we can work together," he said.

https://phys.org/news/2020-11-space-station-years-people-orbit.html

ScienceDaily

Fri, 30 Oct 2020

A new spin on atoms gives scientists a closer look at quantum weirdness

Summary:
A team of researchers has developed a new way to control and measure atoms that are so close together no optical lens can distinguish them.

When atoms get extremely close, they develop intriguing interactions that could be harnessed to create new generations of computing and other technologies. These interactions in the realm of quantum physics have proven difficult to study experimentally due the basic limitations of optical microscopes.

Now a team of Princeton researchers, led by Jeff Thompson, an assistant professor of electrical engineering, has developed a new way to control and measure atoms that are so close together no optical lens can distinguish them.

Described in an article published Oct. 30 in the journal *Science*, their method excites closely-spaced erbium atoms in a crystal using a finely tuned laser in a nanometer-scale optical circuit. The researchers take advantage of the fact that each atom responds to slightly different frequencies, or colors, of laser light, allowing the researchers to resolve and control multiple atoms, without relying on their spatial information.

In a conventional microscope, the space between two atoms effectively disappears when their separation is below a key distance called the diffraction limit, which is roughly equal to the light's wavelength. This is analogous to two distant stars that appear as a single point of light in the night sky. However, this is also the scale at which atoms start to interact and give rise to rich and interesting quantum mechanical behavior.

"We always wonder, at the most fundamental level -- inside solids, inside crystals -- what do atoms actually do? How do they interact?" said physicist Andrei Faraon, a professor at the California Institute of Technology who was not involved in the research. "This [paper] opens the window to study atoms that are in very, very close proximity."

Studying atoms and their interactions at tiny distances allows scientists to explore and control a quantum property known as spin. As a form of momentum, spin is usually described as being either up or down (or both, but that's another story). When the distance between two atoms grows vanishingly small -- mere billionths of a meter -- the spin of one exerts influence over the spin of the other, and vice versa. As spins interact in this realm, they can become entangled, a term scientists use to describe two or more particles that are inextricably linked. Entangled particles behave as if they share one existence, no matter how far apart they later become. Entanglement is the essential phenomenon that separates quantum mechanics from the classical world, and it's at the center of the vision for quantum technologies. The new Princeton device is a stepping stone for scientists to study these spin interactions with unprecedented clarity.

One important feature of the new Princeton device is its potential to address hundreds of atoms at a time, providing a rich quantum laboratory in which to gather empirical data. It's a boon for physicists who hope to unlock reality's deepest mysteries, including the spooky nature of entanglement.

Such inquiry is not merely esoteric. Over the past three decades, engineers have sought to use quantum phenomena to create complex technologies for information processing and communication, from the logical building blocks of emerging quantum computers, capable of solving otherwise impossible problems, to ultrasecure communication methods that can link machines into an unhackable quantum Internet. To develop these systems further, scientists will need to entangle particles reliably and exploit their entanglement to encode and process information.

Thompson's team saw an opportunity in erbium. Traditionally used in lasers and magnets, erbium was not widely explored for use in quantum systems because it is difficult to observe, according to the researchers. The team made a breakthrough in 2018, developing a way to enhance the light emitted by these atoms, and to detect that signal extremely efficiently. Now they've shown they can do it all en masse.

When the laser illuminates the atoms, it excites them just enough for them to emit a faint light at a unique frequency, but delicately enough to preserve and read out the atoms' spins. These frequencies change ever so subtly according to the atoms' different states, so that "up" has one frequency and "down" has another, and each individual atom has its own pair of frequencies.

"If you have an ensemble of these qubits, they all emit light at very slightly different frequencies. And so by tuning the laser carefully to the frequency of one or the frequency of the other, we can address them, even though we have no ability to spatially resolve them," Thompson said. "Each atom sees all of the light, but they only listen to the frequency they're tuned to."

The light's frequency is then a perfect proxy for the spin. Switching the spins up and down gives researchers a way to make calculations. It's akin to transistors that are either on or off in a classical computer, giving rise to the zeroes and ones of our digital world.

To form the basis of a useful quantum processor, these qubits will need to go a step further.

"The strength of the interaction is related to the distance between the two spins," said Songtao Chen, a postdoctoral researcher in Thompson's lab and one of the paper's two lead authors. "We want to make them close so we can have this mutual interaction, and use this interaction to create a quantum logic gate."

A quantum logic gate requires two or more entangled qubits, making it capable of performing uniquely quantum operations, such as computing the folding patterns of proteins or routing information on the quantum internet.

Thompson, who holds a leadership position at the U.S. Department of Energy's new $115M quantum science initiative, is on a mission to bring these qubits to heel. Within the materials thrust of the Co-Design Center for Quantum Advantage, he leads the sub- qubits for computing and networking.

His erbium system, a new kind of qubit that is especially useful in networking applications, can operate using the existing telecommunications infrastructure, sending signals in the form of encoded light over silicon devices and optical fibers. These two properties give erbium an industrial edge over today's most advanced solid-state qubits, which transmit information through visible light wavelengths that don't work well with optical-fiber communication networks.

Still, to operate at scale, the erbium system will need to be further engineered.

While the team can control and measure the spin state of its qubits no matter how close they get, and use optical structures to produce high-fidelity measurement, they can't yet arrange the qubits as needed to form two-qubit gates. To do that, engineers will need to find a different material to host the erbium atoms. The study was designed with this future improvement in mind.

"One of the major advantages of the way we have done this experiment is that it has nothing to do with what host the erbium sits in," said Mouktik Raha, a sixth-year graduate student in electrical engineering and one of the paper's two lead authors. "As long as you can put erbium inside it and it doesn't jitter around, you're good to go."

Christopher M. Phenicie and Salim Ourari, both electrical engineering graduate students, also contributed to the paper. The work was carried out in conjunction with the Princeton Quantum Initiative, and funded in part by the National Science Foundation, the Princeton Center for Complex Materials, the Young Investigator Program of the Air Force Office of Scientific Research, and the Defense Advanced Research Projects Agency.

Story Source:

Materials provided by **Princeton University, Engineering School**. Original written by Scott Lyon. *Note: Content may be edited for style and length.*

Journal Reference:

1. Songtao Chen, Mouktik Raha, Christopher M. Phenicie, Salim Ourari, Jeff D. Thompson. **Parallel single-shot measurement and coherent control of solid-state spins below the diffraction limit**. *Science*, 2020; 370 (6516): 592 DOI: 10.1126/science.abc7821

https://www.sciencedaily.com/releases/2020/10/201030132808.htm

ScienceDaily

Fri, 30 Oct 2020

Dynamic photonic barcodes record energy transfer at the biointerface

Cavity-enhanced radiative energy transfer converts biomolecular information from a single droplet into trillions of distinctive photonic barcodes

Summary:

A team recently developed bioresponsive dynamic barcodes, introducing the concept of resonance energy transfer at the interface of the microcavity.

Optical barcodes enable detection and tracking via unique spectral fingerprints. They've been widely applied in areas ranging from multiplexed bioassays and cell tagging to anticounterfeiting and security. Yu-Cheng Chen of the Bio+Intelligent Photonics Laboratory at Nanyang Technological University notes that the concept of optical barcodes typically refers to a fixed spectral pattern corresponding to a single target.

"Optical barcodes have lacked the capability to characterize dynamic changes in response to analytes through time," says Chen. Thanks to Chen's research, that's about to change.

Chen's group recently developed bioresponsive dynamic barcodes, introducing the concept of resonance energy transfer at the interface of the microcavity. As reported in *Advanced Photonics*, the team demonstrated the barcode experimentally to detect molecules in a droplet. The radiative energy from a single microdroplet is transferred to binding biomolecules, converting dynamic biomolecular information into more than trillions of distinctive photonic barcodes.

Cavity-enhanced radiative energy transfer

The system is based on a whispering-gallery mode resonator (WGMR). The majority of WGMRs are classified as passive. As such, they require evanescent wave coupling and operate based on mode changes induced by perturbations. "In contrast," explains Chen, "active resonators that utilize the analyte as a gain medium can support free-space excitation and collection to acquire more biological information from emission signals."

According to Chen, the trouble when considering molecular detection is the mode occupation factor of the analyte outside the cavity: It is only a few tenths from that inside the cavity, leading to a reduced effective Q-factor and unsatisfactory signal-to-noise ratio. The concept of resonant energy transfer separates donor molecules and acceptor molecules at the cavity interface, where radiative energy transfer happens. Radiative energy transfer is accompanied by electromagnetic radiation (unlike conventional non-radiative fluorescence resonance energy transfer, known as FRET). Because of that radiation, energy transfer can occur even in situations where the donor and acceptor are separated.

"In the presence of cavity-enhanced mechanisms, efficient energy transfer and coupling between donors and acceptors may lead to enhanced light-matter interactions and signal-to-noise ratio," says Chen.

The developed system takes advantage of an effect whereby the high concentration of dye (donor) inside the microdroplet triggers a cavity-enhanced energy transfer to excite the molecules (acceptor) attached to the cavity interface.

"When biomolecules bind to the cavity interface, the number of binding molecules alters the amount of energy transfer, resulting in distinctive modulated fluorescence emission peaks," says Chen. Dynamic spectral barcoding was achieved by a significant improvement in the signal-to-noise ratio upon binding to target molecules.

According to the authors, this biomolecular encoding system illuminates a beacon for real-time intermolecular interaction and can greatly increase the complexity of an encoding system. They believe the concept can be widely applied in many biosensing applications and optical encryption.

Story Source:

Materials provided by **SPIE--International Society for Optics and Photonics**. *Note: Content may be edited for style and length.*

Journal Reference:

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COVID-19 Research News

Medical Dialogues
.....Daily Dose of Health & Medical News

Sun, 01 Nov 2020

BCG vaccine could aid elderly fight COVID: ICMR

and the test-firing produced desired results, they said

New Delhi: The Bacille Calmette-Guerin or BCG vaccine, originally made against tuberculosis, may help in the management of Covid-19, especially in the elderly, says a study by the Indian Council of Medical Research (ICMR).

The BCG vaccination is known to induce innate immune memory, which confers protection against several infections, the study uploaded as preprint at medRxiv, reported.

"We investigated the impact of BCG vaccination on the frequencies of T cell, B cell, monocyte and dendritic cell subsets," the study researchers from ICMR wrote.

"We also investigated total antibody levels in a group of healthy elderly individuals (age 60-80 years) at one month post vaccination as part of our clinical study to examine the effect of BCG on Covid-19," they added.

The results showed that BCG vaccination induces enhanced innate and adaptive immunity in elderly individuals which may prove beneficial against the coronavirus.

The results showed that BCG vaccination induces enhanced innate and adaptive immunity in elderly individuals which may prove beneficial against the coronavirus.

"Finally, BCG vaccination resulted in elevated levels of all antibody isotypes," the researchers wrote.

"BCG vaccination was associated with enhanced innate and adaptive memory cell subsets, as well as total antibody levels in elderly individuals," they concluded.

Earlier in October, as part of a large-scale global trial, scientists in Britain launched a study to test if the widely-used BCG vaccine could help protect people against Covid-19.

A study published in the journal 'Cell Reports Medicine', also revealed that the BCG vaccine has a general stimulating effect on the immune system and is, therefore, effective against Covid-19.

https://medicaldialogues.in/news/industry/pharma/sanofi-regeneron-win-eu-patent-case-against-amgen-over-praluent-71004?infinitescroll=1

THE TIMES OF INDIA

Mon, 02 Nov 2020

Bharat Biotech to launch Covaxin in Q2 2021

New Delhi: Bharat Biotech is planning to launch its vaccine for Covid-19 in the second quarter next year if it gets the requisite approvals from the Indian regulatory authorities, a top company official said.

It said its immediate focus is to conduct the Phase 3 trials successfully across sites in the country.

The company's vaccine candidate- Covaxin- has been developed in collaboration with the Indian Council of Medical Research (ICMR) - National Institute of Virology (NIV) using inactivated Sars-Cov-2, the virus that causes Covid-19. The virus was isolated in an ICMR lab.

"If we get all the approvals after establishing strong experimental evidence and data, and efficacy and safety data in our last stage of trials, we aim to launch the vaccine in Q2 of 2021," Bharat Biotech International executive director Sai Prasad told PTI.

After the company received approval from the Drugs Controller General of India (DCGI) to conduct Phase 3 clinical trial to establish the efficacy of the vaccine candidate, it has begun site preparatory exercises for Phase 3, recruitment and dosage will begin in November, he added.

"The trial to be conducted in 25 to 30 sites across 13-14 states, will provide two doses each for the vaccine and placebo recipients. About 2,000 subjects could be enrolled per hospital," Prasad said.

Asked about the investment on the vaccine, he said: "Our investment is about Rs 350-400 crore for the development of vaccine and the new manufacturing facilities, which include our investments for conducting the Phase 3 clinical trial, in the next six months".

On the company's plan to sell the vaccine to the government or to private players, Prasad said: "We are looking to supply for both government and private markets. We are also in preliminary discussions with other countries for probable supply." Prasad said the price of the vaccine is yet to be determined, as the company is still looking at the cost of product development.

"Our immediate focus is to conduct Phase 3 trial successfully across sites," he added.

https://timesofindia.indiatimes.com/india/bharat-biotech-to-launch-covaxin-in-q2-2021/articleshow/78979100.cms

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